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The Miami Conservancy Bulletin

DECEMBER, 1922

FIG. 379—VIEW OF THE IMPROVED RIVER CHANNEL IN DAYTON, LOOKING UPSTREAM FROM NEAR MILLER'S FORD, NOVEMBER 23, 1922.

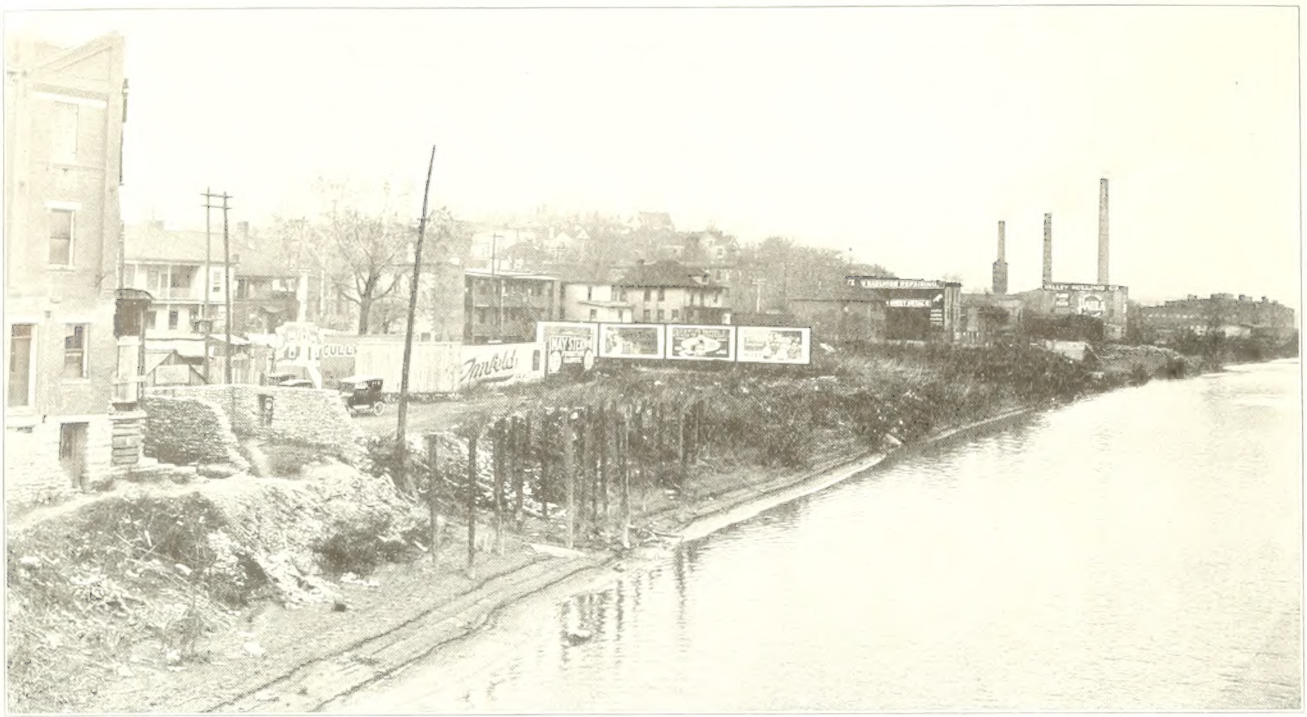

FIG. 380—THE WEST BANK OF THE MIAMI AT HAMILTON, LOOKING UPSTREAM FROM THE MAIN-HIGH BRIDGE, MARCH 1, 1918.

The three-story building and the old stone foundation shown in the left of the picture were in the way of the proposed levee, and obstructed the waterway of the Main-High bridge. The river bank above the foundation contained piling, old foundations, trash, projecting sewers, and was covered with a heavy growth of willows. The portion of the city to the west was subject to overflow from high river stages as there was no levee at this point. The river bank was unsightly, and was insanitary as well.

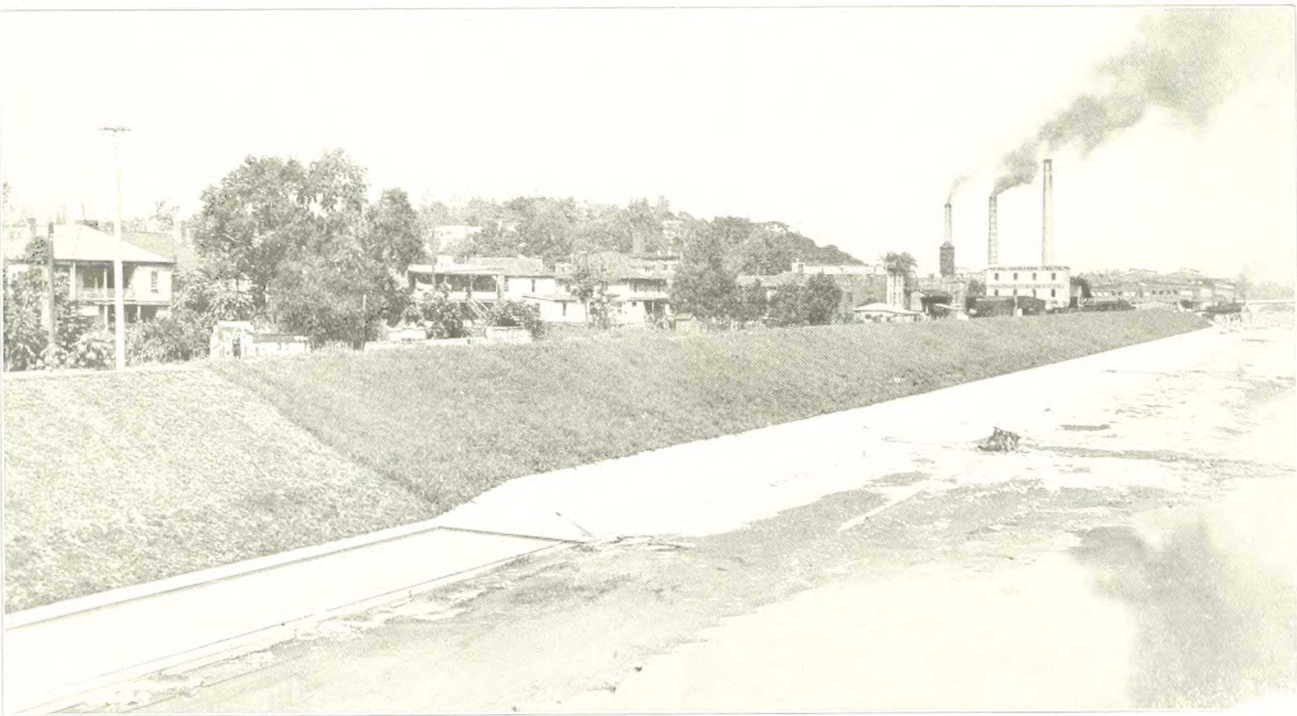

FIG. 381—THE WEST BANK OF THE MIAMI AT HAMILTON, LOOKING UPSTREAM FROM THE MAIN-HIGH BRIDGE, TAKEN SEPTEMBER 23, 1922.

This view shows the same territory as Fig. 380. The three-story building and the old foundation have been removed and the river widened somewhat. The river channel has also been deepened and cleared of bars along the shore. The piling, old foundations, trash and other obstructions have been taken out. A substantial earthen levee has been built to protect the west side of Hamilton. The wide white band along the base of the levee is the concrete revetment. At the foot of the revetment is a flexible mat made up of concrete blocks, woven together by galvanized cables. The portion of the levee above the revetment has been sown to grass, and good growth has resulted. The wall shown in the lower left hand corner is the beginning of the transition from the river section to the bridge opening. The clean banks and grassy slopes of the new levees have been a great civic improvement for Hamilton.

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THE MIAMI CONSERVANCY BULLETIN

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Index

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The Finishing Touches.

The five dams of the flood prevention works were virtually completed last winter, and the condition of the work in the cities was such that the valley was safe against a repetition of the 1913 flood. Another season's work was necessary before the cities were fully prepared for the forty percent greater flood than 1913, for which the works were designed. Today the system, save for a few finishing touches, is completed. The finishing touches take time, but by spring they, too, will be finished, and the Miami Conservancy will be on a maintenance basis.

Salvage and Sales.

Since the last Bulletin was published, nearly all of the units of the Conservancy work still under way at that time have been completed, and the equipment and left-over materials and supplies have become available for sale. The Conservancy shops have been busy overhauling the equipment and putting it in condition to be placed on the market. Excellent progress has been made in the actual selling. Total sales passed the $800,000 mark early in December. This progress has been made in the face of the usual fall in activity in the construction field.

The Conservancy District purchased good machinery. The size of the job made it economical to maintain a first class repair shop manned by a crew of expert repairmen. The equipment received a repair and overhauling service that was unusually thorough. Parts that failed under the stress of service were reinforced when replaced. As a result the equipment offered for sale is sturdy, is in excellent operating condition, and is none the worse for the hard service given it while building the Flood Prevention Works.

For the same reason that the District could maintain repair shops, it was able to secure the services of competent men to plan equipment layouts. The District is giving to prospective buyers an advisory service in planning their plants. Customers are being encouraged to avail themselves of this service, and to look over the District's stock before reaching a final decision on what they wish to buy.

A Maintenance Engineer Appointed

Mr. C. H. Eiffert was appointed Maintenance Engineer of The Miami Conservancy District on December 1, 1922. He has been with the District for seven years. For the past five years he has been Division Engineer in charge of the river improvement work at Hamilton. Before that he was engaged on the preparation of plans and specifications for various features of the project. He is a graduate of Cornell College, Iowa, and a member of the American Society of Civil Engineers.

The creation of the office of Maintenance Engineer marks a definite step in the change of the Conservancy organization from a construction to a maintenance basis. The flood control works are now practically completed, and have been ready to handle floods for the last year or more. The upkeep and maintenance of the various features of the project are of principal importance from now on, and the Maintenance Engineer will be directly responsible to the Chief Engineer's office for that feature of the District's operations.

Local Improvement in Dayton Finished.

Everything Ready to Handle Safely a Forty Percent Greater Flood Than That of 1913.

On September 21st, the two big draglines, one working downstream, the other working upstream, met on the left bank of the Miami between Stewart Street and Miller's Ford, and completed the excavation on the Dayton Division. While the usual cleaning up operations remain to be done, the flood protection works themselves are completed.

In future years, when the heavy spring rains come, and the streams of the valley give their annual performance, the Miami through Dayton will not act as it has in the past. Instead of the angry, tumbling waters that have been so characteristic of high waters in the old days, the river will move swiftly and smoothly on its way. Only during extremely large floods will the water approach the tops of the levees. The high stages will last longer than before, as the waters held back by the dams will flow off gradually after the rains cease. As the water in the river rises, gates in the sewers and other openings will be closed, so that water will not back through the openings to flood the lower parts of town. Surface water that collects in low places back of the levees will be pumped off by means of electrically driven pumps kept ready at all times for this emergency. Dayton is ready for any flood that may come along.

The more spectacular features connected with the construction of the dams have caused many persons to overlook, to some extent, the importance of the river improvement works in the cities. The works of the District are like a chain, and are dependent upon each other for strength and safety. The dams hold back the water that cannot be taken care of by the river channels through the cities. To a certain extent, channel improvement in all of the towns was feasible and economical. Much capacity could be gained by removing bars and islands and by deepening, widening or straightening the channel. At Dayton, however, the numerous concrete bridges, and the valuable property adjacent to the river, placed a very definite limit to channel enlargement.

The problem of keeping the river channels free from bars is an important one. The sands and gravels composing the bed of the Miami are constantly shifting. Even moderate high waters carry with them a surprising amount of material. The cause of bars forming is a decrease in the velocity of the stream. A wide place, a log, a change from a steep slope to a less steep slope, growth of willows, will any of them cause a check in the velocity of the water and cause the water to drop its burden of gravel to form a bar. Once started, the bar aggravates conditions, and increases the volume of the deposits.

Therefore, the purpose of the channel improvement in Dayton has been to produce as large a channel as could be made within the limits imposed, uniform in size, and on uniform grades. It was necessary to actually narrow up the old channel in certain places to prevent decrease in velocity, and at others to remove houses and the old levees in order to make room for the enlarged channel. As the improvements in most cases will result in increased velocities of flow, it was necessary to protect the levees in certain places by revetment. All of the many operations in Dayton were incident to the carrying out of this simple plan.

The flood of 1913 produced a maximum flow in the Miami River at the Main Street bridge in Dayton of about 250,000 cubic feet per second—about three and one-half times the capacity of the old

FIG. 382—LOOKING UPSTREAM AT THE JUNCTION OF THE MAD AND MIAMI RIVERS, DAYTON, SEPTEMBER 15, 1922.

The Mad is on the right, the Miami on the left. The bridge in the background is the one at Webster Street. The white streaks on the levees are revetments protecting the base of the levees against scour. Eventually the reclaimed land between the two rivers, and the open space in the right of the picture, will become city parks.

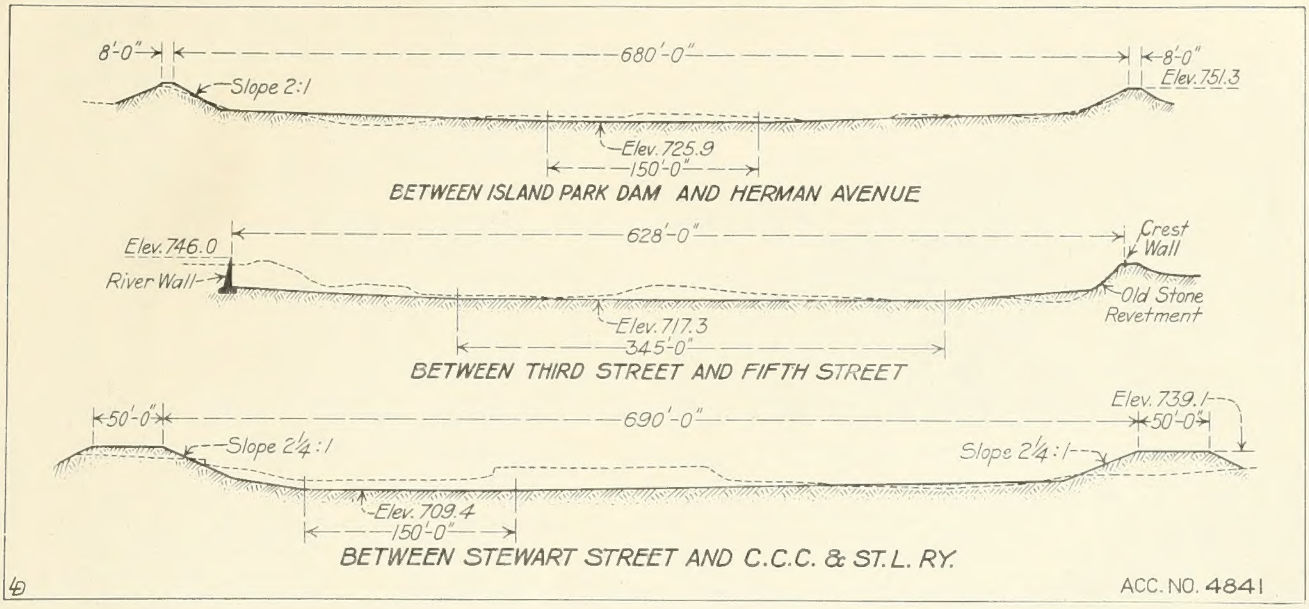

FIG. 383—THREE CROSS-SECTIONS OF THE RIVER CHANNEL THROUGH DAYTON. The solid lines represent the improved waterway. The dotted lines show conditions as they were before the Conservancy work started.

channel. The new channel is designed, in conjunction with the retarding basins, to take care of a forty percent larger flood than that of 1913. If a flood that size should occur, the basins will let only enough water pass to produce a flow of 75,000 second feet in the Miami above Mad River, 110,000 second feet at Main Street, and 120,000 second feet below the mouth of Wolf Creek, and the water will only reach the freeboard line, three feet below the tops of the levees. A flood a great deal larger than forty percent greater than 1913 would have to occur before the levees would be overtopped. Figure 383 shows the dimensions of the channel at various points.

The old river channel of the Miami was very crooked in the first place, and in comparatively recent times occupied land now occupied by the buildings of Dayton. Past attempts at control have confined the river within definite limits, but the river bed still is very winding through the city. The new alignment follows the old channel very nearly, takes advantage of the old improvements, and is composed of long, easy, smooth curves, and some short straight stretches. The levees are parallel to each other, very nearly. At constricted places, where the value of the property adjacent to the river was very high, and at the bridges, where a change in the shape of the river channel was necessary, concrete walls were used instead of levees. The distance in elevation between the bottom of the new river bed and the tops of the levees is about twenty-eight feet. The bridge openings, with their piers and arches, offer some obstruction to the flow of the stream, and some head or elevation is necessary to overcome the resistance. Thus at high stages, the water on the upper side of the bridges will be a foot or so higher than on the lower side. In building the levees, advantage was taken of this and the tops of the levees below the bridges are a foot or so lower than the levees above. When the river is running full, water crowds to the outside of the curves, so the levees on the outside of the curves are made a little bit higher than those on the inside. The low water channel is on the outside of the curves, also The natural tendency of a stream is to crowd outward on the curves, and the artificial bed will be more stable if the deepest part is placed where nature would place it.

During low water the stream will occupy the low water channel. A moderate stage of water will put the river over the gently sloping beaches and against the levees. At flood stages the waters will try to eat into the banks of the levees on the outside of the curves. To give the water something too hard to cut, the outside of all curves has been protected by concrete revetment. At the most exposed places the lower portion of the steep levee slope is covered by a solid reinforced concrete slab similar to a side-

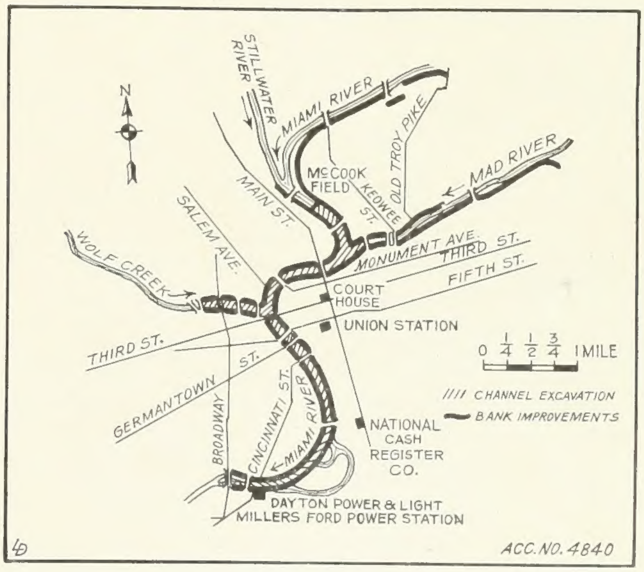

FIG. 384—SKETCH SHOWING THE COURSES OF THE MIAMI, MAD AND STILLWATER RIVERS AND WOLF CREEK THROUGH DAYTON.

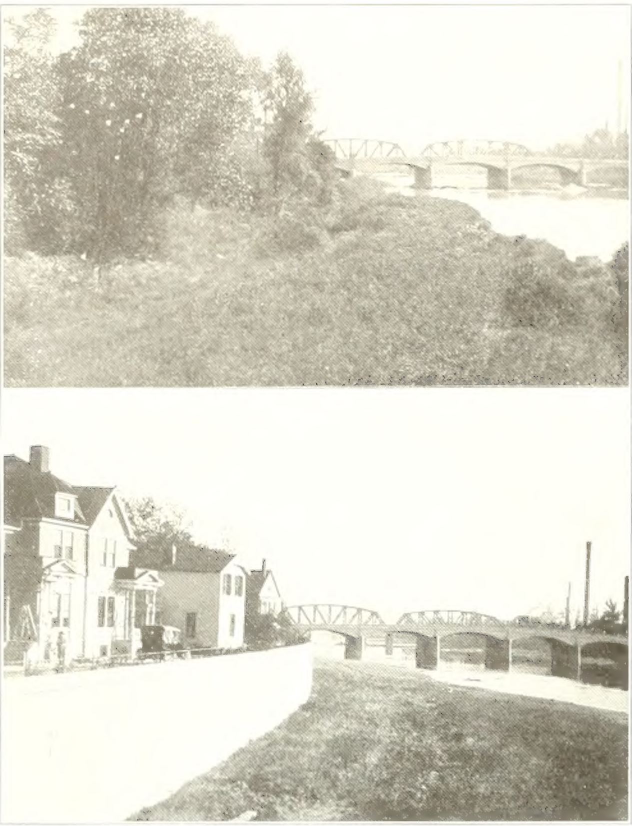

FIG. 385—BEFORE AND AFTER PICTURES OF THE LEFT BANK OF THE MIAMI RIVER BELOW THIRD STREET, DAYTON.

The views were taken looking downstream from the Third Street Bridge. The projecting point, covered with a tangled mass of vegetation, shown in the upper picture, is typical of a number of similar obstructions to the river flow that existed before the Conservancy work was started. The lower view shows the completed improvement. The high value of the real estate involved made it cheaper to build a wall than to buy enough right-of-way for a levee.

walk tilted up on edge. This does not reach to the top of the levee, as floods so large that the water would come above the top of the revetment will be so infrequent that a good sod is sufficient to protect the upper part of the levee. The beach at the toe of the levee is protected by a flexible concrete mat made up of concrete blocks, twelve inches wide, twenty-four inches long, and five inches thick, each one pierced by two holes and strung together on galvanized wire cable. This phase of the work was described in detail in the November, 1920, Bulletin.

The work in Dayton naturally divided itself into three parts, each quite different in character, and requiring different equipment. The first of these in importance was the channel excavation and levee building. The excavating machine used was the dragline. The greater part of the work was done with the two largest draglines on the District's work, the class 175 Bucyrus. So well are they proportioned that only by getting them beside some familiar object can their size be appreciated. The machines weigh 225 tons, the booms are 125 and 135 feet long, the buckets hold three and one-half to four and one-half cubic yards, and the reach in a 180-degree turn is 250 to 270 feet. The motive power is electricity. The two big machines were reinforced by two smaller ones, a class 9½ Bucyrus steam machine and a class K Lidgerwood electric. These machines did the odd jobs that the big machines did not have time for, or were too large to do. The Lidgerwood also did all of the work below the Miller's Ford transmission lines and finished nearly two thousand feet of levee above that point.

From the Island Park Dam to the mouth of Wolf Creek only a small amount of the material that was removed from the channel was needed to enlarge the levees. So valuable was the property adjacent to the work that at only a few points could sufficient waste land be secured on which to dump the surplus material. This made it necessary to transport the material from the excavating machines to the dumping grounds. On this particular stretch of river it was considered cheaper to use floating equipment, and to provide slack water, a temporary dam was built across the Miami at Wolf Creek, giving a ten-foot depth of water in the improved river above. One of the big dragline machines was mounted on a scow. The excavated material was loaded onto other scows by this machine, and the loaded scows were pushed by the steamer, "Dorothy Jean," to the spoil banks where they were unloaded by another machine. This operation was a familiar one to all Daytonians, and was fully described in the May, 1919, Bulletin and pictorially shown in various other Bulletins. An area on the west bank of the Miami just below the Herman Avenue bridge and a triangular area at the junction of the Mad and the Miami, and an area at the mouth of Wolf Creek, were reclaimed with the excavated material, and in time will become city parks.

The levees were built up in various ways. A great deal of care was taken to preserve the old trees growing on the levees. The trees were so large and dense in some cases that the draglines could not swing their booms over the levees, and teams or cars had to be used to bring in the earth. The levees were dressed with good soil, planted to grass, and carefully tended so that a good growth of sod has been produced. This growth will keep the rains from washing gullies into the fills.

The temporary dam at the mouth of Wolf Creek performed the duty expected of it very well. Considerable thought was given to the problem of removing it, but the Miami saved all that trouble when one stormy night the river washed the dam away, just a short time after the work above it had been finished.

From Wolf Creek to Fifth Street scowing was continued by excavating a channel sufficiently deep for floating scows. From Fifth Street to a point about 700 feet below Washington Street, nearly all of the surplus channel excavation had to be hauled out to low areas on the right bank near Stewart Street. Standard gauge locomotives hauling air dump cars were used, as it was not practicable to use the floating equipment on this stretch of river.

From below Stewart Street to the railroad bridge just below Cincinnati Street, the improved channel runs for some 8000 feet through the lowland ordinarily subject to overflow from every rise in the river, and consequently not occupied by many buildings. More than 1,000,000 cubic yards of material

were taken out of this section of the work. The general plan that was followed was to start the dragline down the center of the river, excavate the material, and deposit it in a windrow as far over towards the river bank as the machine would reach. Then the same machine, or one following right behind it, would pick up the material again, swing around in a half circle, and deposit it again in another windrow still closer to the bank. It was cheaper to make three throws with the machine than to load and transport the earth, although it was usually necessary to make only one or two throws to get the material into final position. The first earth formed the levee, and the surplus was put back of the levee, so that in some places the width of the

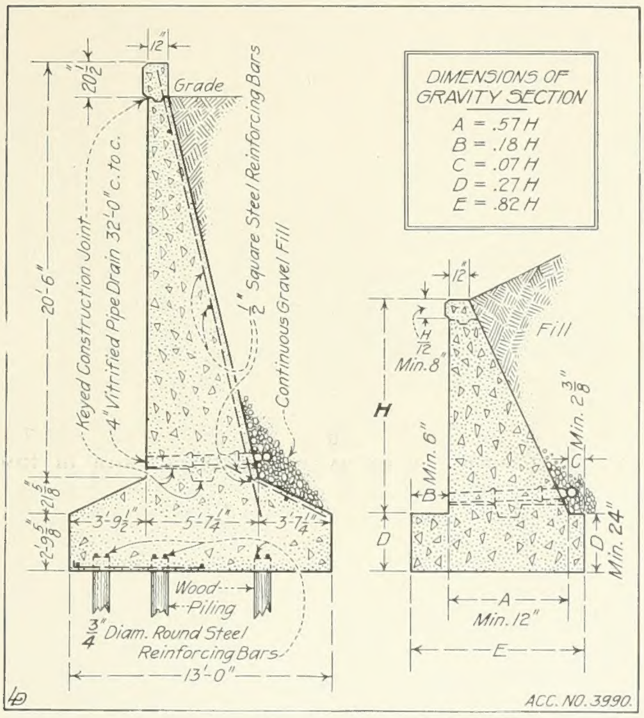

FIG. 386—CROSS-SECTIONS OF TYPICAL RETAINING WALLS BUILT IN DAYTON.

fill is wider than at others. At some time in the future a boulevard will run down on one or both sides of the river, and this territory, once an eyesore to the town, will be transformed into a far different sort of a district than it is now.

In cleaning out the river, more than 2,000,000 cubic yards were excavated, and either placed in the levees, dropped into deep holes in the river or placed in the spoilbanks. Of the 2,000,000 cubic yards, 723,000 cubic yards were used to enlarge the levees and in addition 129,000 cubic yards were taken from borrow pits for the same purpose. To accomplish all this work, the draglines traveled up and down and across the river, a total distance of over thirty-three miles. Some special work at cleaning out under the bridges was necessary. On Wolf Creek it was possible to build much of the levee with the small dragline. At other points sections of levee were built with teams.

The Miami River is crossed by a number of water and gas mains and sewers. In thirteen cases these had to be lowered to get them below the new river bed and one entirely new main was laid. This lowering proved to be an annoying job, but an interesting one. The Bulletin has described some of the operations in the December, 1918, issue. Subsequent lowerings were carried out in much the same way. Each one was an adventure in a way, for the river had a perverse habit of coming up at critical moments, and threatening to wash out the work.

The various walls and revetments comprise the group of jobs next in importance to the excavation in the channel. Forty-one walls, ranging in size from the South Robert Boulevard river wall, 1036 feet long and 25 feet high, including the foundation, to the little one at the central fire station, but 44 feet long and five feet high, were built. Figure 386 is a good illustration of these. The Bulletin has said a good deal about this phase of the work in the November, 1920, March, 1920, and March, 1921, numbers, and a detailed account of the work is not necessary here. As far as possible old walls were worked into the new scheme, by extending and raising them. The proximity of buildings in some cases proved to be a complication that required the most careful work to prevent damage to the abutting property. By the use of sliding forms, and by careful planning of plant, the work which ordinarily would prove to be exasperatingly slow and expensive, was so standardized that it moved forward rapidly and economically.

The novel features of the revetment attracted so much attention that articles about it appeared in the November, June, and January, 1920, and the August, 1919, Bulletins. Little can be added save that 7765 cubic yards of the slab, and 2954 cubic yards of the flexible revetment were placed in Dayton.

The odd job group is the third section of the work. Each item deserves a story in itself. When the existing state of affairs was disturbed in Dayton, all kinds of things bobbed up. Sewer outlets had to be lengthened. Flood gates had to be installed on pipe lines through the levees. The new levee changed drainage conditions in some localities, and the rain washed gravel into Mrs. Murphy's cellar, and that also had to be taken care of. Street grades had to be rectified, and sewer manholes changed. Some of these items could be definitely anticipated, others could not be except in a general way. Taken altogether, the odd jobs form a work of no mean size and importance.

Construction machinery makes considerable noise, especially during hot, still summer nights, when sleep comes slowly. Some families had concrete plants at their back doors for a time. Mufflers were used, and other devices employed to reduce annoyance from this source, but the work was a nuisance to many people especially during the night shift. The patience of the citizens who were within hearing distance of the river was remarkable. Every one seemed to realize the necessity of the work, and nearly every one helped by not complaining. Noise now is a thing of the past, and when spring comes the grass will cover the new levees, and cover the scars made by the work. Dayton is secure against the flood danger.

Adams Street Bridge at Troy Completed

The Success of the Novel Undertaking Can Now Be Recorded.

The unusual feature of constructing a new concrete bridge on top of a similar structure already in place, using the old bridge to support the forms for the new, was present in the reconstruction of the Adams Street Bridge at Troy. The work has just been completed, and the success of the novel undertaking can now be recorded.

The Official Plan of the District originally provided at Troy for a deep water channel for the Miami River, following the old river closely, and using the bridges as they then stood. Very large floods were to have been taken care of by making the levee on the north side of the river low enough so that a large flood would overtop the banks, and flow over the low ground to the north.

composed of twelve-foot piling, but some of the piling proved to be only three feet long. The waterway under the bridge was wholly inadequate for the new plan.

The first idea would be to wreck such a bridge and build another. To remove a concrete bridge, especially the piers, is a big job and an expensive one. The District calculated that it would be cheaper to reinforce the old piers and use them to carry the new bridge and to use the old arches to carry the falsework for the new, and to add extra arches at one end, than to build an entirely new bridge. The obvious expedient of building a new bridge on a different site and digging a hole and blowing the old bridge into it, was barred because it was neces-

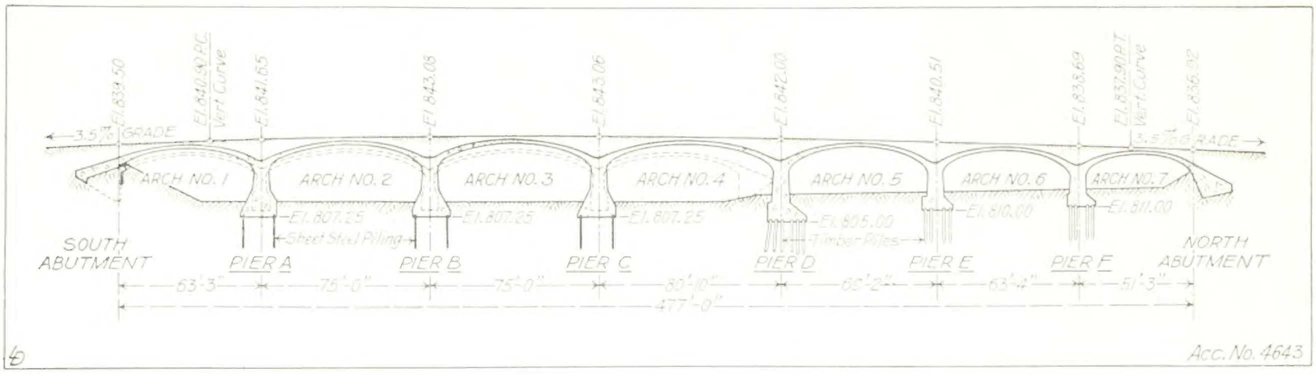

FIG. 387—ELEVATION OF THE RECONSTRUCTED ADAMS STREET BRIDGE, TROY.

The position of the old arches and the outline of the piers before they were enlarged, is shown by the dotted lines. The reconstructed bridge is shown by the solid lines. The enlargement of the old piers, and the protective sheet piling around them, should be especially noted.

But as the time to build the works drew near, the Miami County people decided that a much more desirable plan for the future beautification of Troy would be to confine the flood channel within definite limits, lengthen the bridges to accommodate the enlarged river, and fill in and beautify the remainder of the overflow area. Leaving out the reconstruction of the two river bridges, the cost of the new plan did not greatly exceed the Official Plan. Miami County agreed to pay for lengthening the two bridges if the new plan was adopted. When the change was approved by the Conservancy Court, the County entered into an agreement for the District to do the bridge reconstruction work for the County.

The Market Street Bridge had two steel trusses and by adding another span, sufficient waterway was secured. This work was mentioned in the May, 1921, issue of the Bulletin.

The Adams Street Bridge reconstruction was more of a problem. The old bridge was built in 1913, and consisted of four reinforced concrete arches. See Figure 387. The outward appearance of the structure was good, but the pier footings were inadequate and some of the concrete was in bad condition. The footings were so narrow that they could not take care of the unbalanced forces from the new arches with a sufficient margin for safety. They were also set practically on top of the river bed, and were placed on a foundation supposed to be

sary to use the old site. The cost of securing the necessary property for the approaches to a new site was prohibitive.

Some very definite advantages were to be had by following this rather novel plan of utilizing the old bridge. The danger of floods washing out the timber falsework was done away with, as a clear waterway always remained under the bridge. Less timber was necessary in building the forms. No additional right-of-way was necessary. Considerable saving in

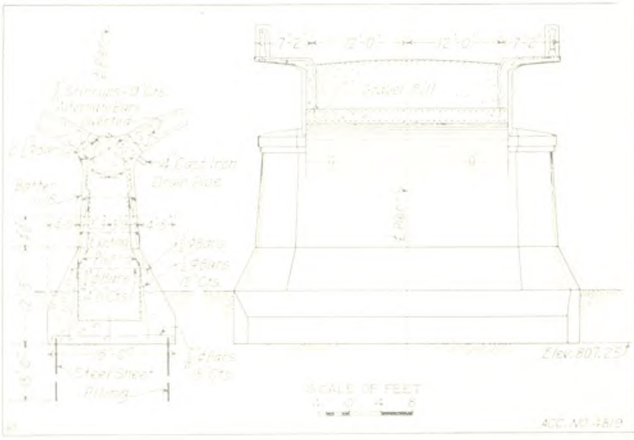

FIG. 388—SKETCH ILLUSTRATING THE ENLARGEMENT OF THE BRIDGE PIERS ON THE ADAMS STREET BRIDGE, TROY.

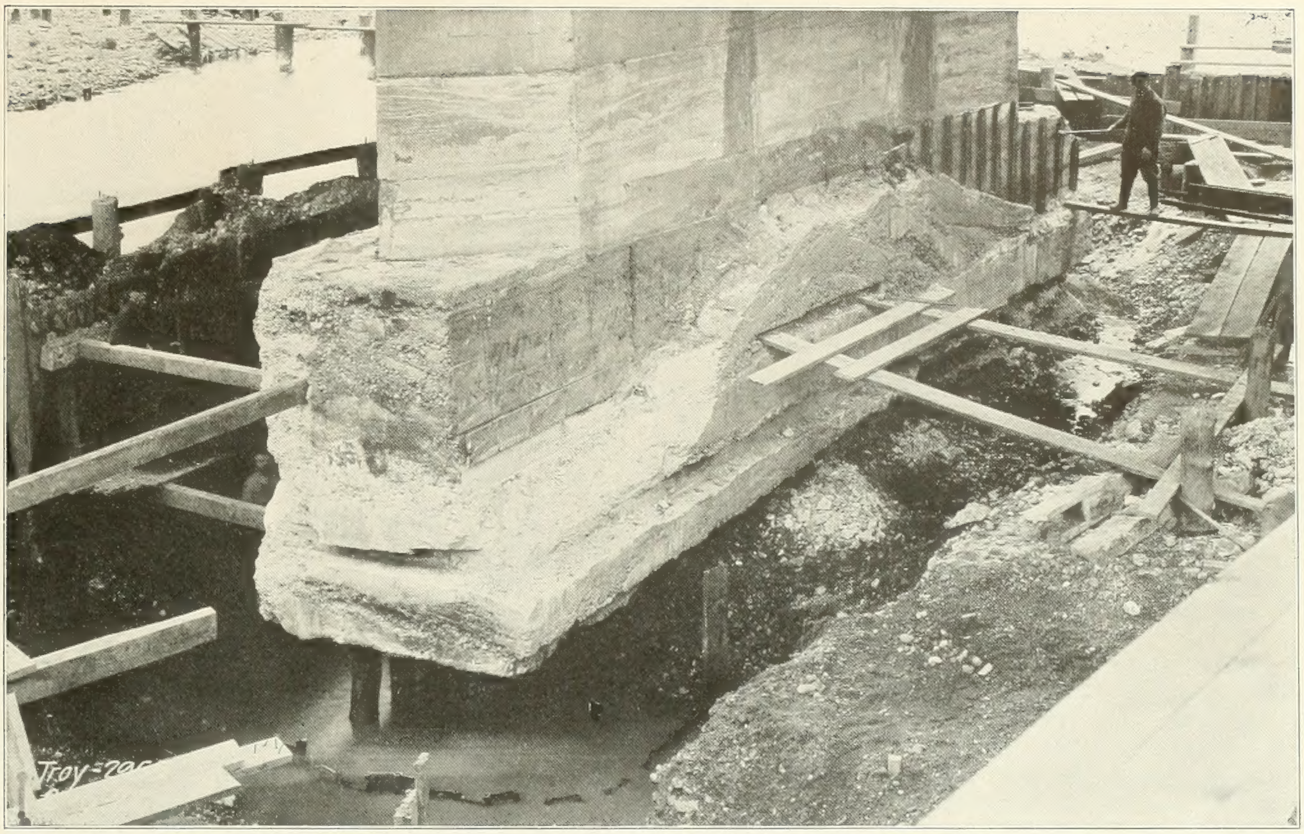

FIG. 389—A PIER OF THE ADAMS STREET BRIDGE READY FOR UNDERPINNING, FEBRUARY 6, 1922.

A coffer dam had been built, the gravel removed from around the pier, and the excavation made underneath the first third of the footing. The wooden piling underneath the old footing should be noted. The top of the line of protective sheet steel piling can be seen sticking out of the water in the bottom of the pit. Concrete was packed underneath the old footing, and the entire pier was encased in a jacket of concrete.

the volume of concrete was secured. The disadvantages were principally in the trouble of reinforcing and underpinning the old piers, and in the adventuring into the unknown which this novel plan necessitated. Without precedent to go by, the greatest of care and thought was necessary to insure the success of each step in the work.

The design of the new bridge was simple. The irregular length of the spans of the old bridge governed the length of the three comparatively short spans that were added at the north end, as the principle was adhered to of having the center span the longest, and having the spans decrease somewhat uniformly towards the ends. The deep water channel through Troy follows the old river channel and runs under the old bridge. The entire bridge is designed to carry a concentrated live load of one twenty-ton truck, with fourteen tons on the rear wheels and six tons on the front wheels. The sidewalks are designed to carry a live load of 100 pounds per square foot. The materials will receive a maximum stress under total dead and live loads of 500 pounds per square inch for the concrete, and 14,000 pounds per square inch for the steel. These stresses are about one-quarter of stresses that would break the materials. A variation of eighty degrees in temperature was considered a maximum. With the maximum temperature stress added to the maximum loading, the concrete would be stressed to 735 pounds per square inch, and the steel to 16,000 pounds per square inch, which are well within the limits of safety.

The deep water channel was under the old bridge, and therefore the building of the extension on the north end of the old bridge was carried on in the dry. Concrete sills were used to carry the posts for the falsework. The superstructure and forms commonly used for the piers, arches, and abutment of concrete bridges, were used for these three arches. No unexpected contingencies came up and no unusual construction methods were employed.

The spandrel walls, sidewalks, fill and paving were a considerable part of the dead load on the old bridge. They were removed before much work was done, in order that as little load as possible would be on the piers while they were being enlarged. It was necessary to remove these carefully and to unload all arches simultaneously and uniformly. Otherwise, unbalanced forces might have pushed over one of the piers. Most of the work was done by hand. Small shots of dynamite were used in breaking up the concrete wherever possible in order to lighten the hand work.

The first job in reconstructing the old bridge, was to enlarge and deepen the footings. The rebuilt footings are almost twice as wide as the old ones, and extend about three feet deeper into the river bed. A coffer dam of earth was thrown up around the pier, the water was pumped out, and the material around the footing excavated by hand. Taking one-third of the length of the old footing at one time, the excavation was carried three feet below the bottom of the old footing, and then underneath. It was then that the condition of some of the old wooden

piles was disclosed. Sheet steel piling fifteen feet long was driven one foot inside of the line of the new footing and projecting up one foot into the footing. Concrete was packed into the space underneath the old footing, and around the old piles out past the line of the sheet piling. When the concrete was set, the next third was dug out, and the operation repeated. Figure 389 illustrates the procedure.

When the underpinning was all completed, holes were drilled through the old piers and the tie-rods placed through them. Then a jacket of concrete was placed entirely around the old piers, the network of steel in the jacket being held in place by the tie-rods.

The reconstruction work on the piers and the south abutment did not turn out to be as difficult as was anticipated, although high water stopped the work a number of times. The difficulty of driving sheet piling in the restricted space under the bridge was overcome by the use of a small, compact steam hammer.

The north abutment had to be replaced by a new pier immediately north of it. See Figure 390. As the excavation for the new pier removed the bearing from behind the old abutment, some means of supplying a temporary support until the old bridge was taken down, was necessary. Figure 390 shows how this was accomplished. The heavy timbers, wedged against concrete footings, were placed in line with the direction of the force against the abutment and braced to prevent buckling. Then the excavating was done, and when the pier was poured, the concrete was boxed around the timbers. The holes so left were filled in after the completion of the bridge permitted the removal of the brace for the old abutment.

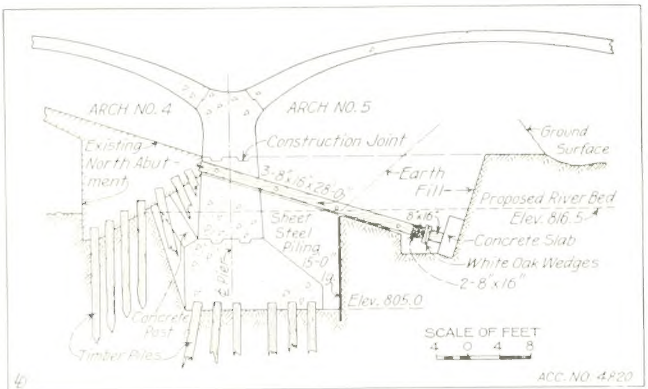

FIG. 390—SKETCH SHOWING CONSTRUCTION OF NEW PIER BEHIND THE OLD ABUTMENT OF THE ADAMS STREET BRIDGE.

When all of the upper part of the old bridge save the arches was removed and the piers had been reconstructed, the forms for the new arches were built on top of the old bridge. The only difference from the forms ordinarily used on such work was in the posts. Instead of the long bents resting on piles or sills in the river bed, the posts were short, and rested on top of the old concrete arches, leaving an unobstructed waterway.

As the posts carrying the arch forms for the new spans on the north end rested on the ground, these arches could be poured in the usual way. But on the part of the new bridge that rested on the old, a different method was necessary. To have poured each new arch complete would have caused an unbalanced loading on the piers that could have been dangerous. So each arch was poured in three longitudinal sections, one section being poured on all of the arches, and then another, and finally the third. By proceeding in this manner, the unbalanced thrust on the piers did not exceed a safe figure.

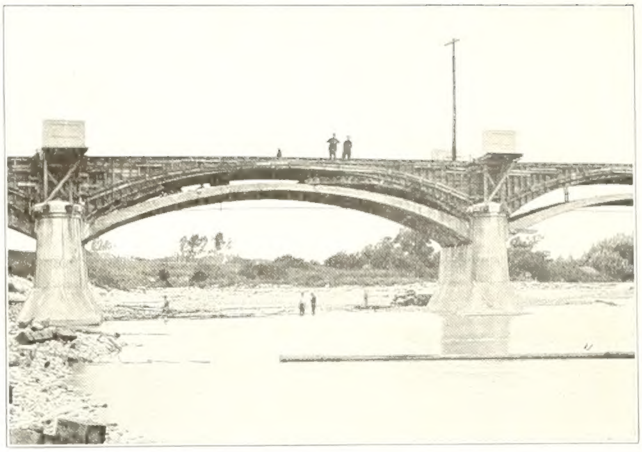

FIG. 391—ADAMS STREET BRIDGE, AUGUST 21, '22. Both the old and the new arches are in position. The forms were being removed from the new arch when this picture was taken.

When the new arch rings had set, the most ticklish part of the job, the removal of the old arches, remained to be done. Underneath the bridge a trench was dug, deep enough so that the old concrete falling into it would all be below the grade of the improved channel. Then one-inch holes were drilled through the old arches seven feet apart longitudinally and three feet apart laterally, and corresponding holes were cast into the new arches above. The holes were placed so that they would be ready for a certain contingency. Due to the same difficulty about having too large an unbalanced thrust on the piers, the old arches had to either all come down at once, or else be removed uniformly. To have one old arch all removed with the others still standing might spell disaster. The practical difficulty of so managing affairs that all of the arches would let go and fall at the same moment was so great that this method was not seriously considered. So the piecemeal method was the one decided upon. The holes mentioned above were so arranged that bolts could be run through them, taken up a bit, and the lower arches suspended from the upper ones, in case that during the operations hereafter described, the old arches showed any sign of failure. If this had happened, the suspended weight would have been very nearly equal on each side of each pier. The wrecking of the old arches was much easier than had been expected. Scaffolding was suspended from the upper arches by means of rods run through the holes mentioned above, and workmen using sledges, small charges of dynamite and chisels, began taking out little bites from all of the arches, working at about the same rate on all of them.

The net-work of reinforcing steel held the old concrete together very well, and the steady nibbling reduced each arch to a very narrow rib, without any necessity arising of suspending any of the old struc-

FIG. 392—ADAMS STREET BRIDGE, OCTOBER 14, 1922.
The old arches have been removed, but some of the old reinforcing steel with chunks of concrete clinging to it can be seen under the 3rd arch from the right. The rods hanging down from the underneath side of the new arches were used to carry the scaffolding that supported the wrecking crews. If the necessity had occurred the old arches would have been carried by these same rods during the wrecking process.

ture from the new. These last narrow ribs were cut and dropped without incident.

As soon as the success of the wrecking operations was assured, the new spandrel walls and sidewalks were started. The spandrel walls are built without brackets or batter. The sidewalks are cantilevered out without brackets. No unusual features were developed on either of these two items.

The construction plant was not elaborate. A derrick dug the gravel needed in addition to that already piled up on the site by the dragline. A portable gravel-washing and screening plant prepared the material for use. The aggregates were loaded into the Smith one-yard mixer by gravity, and the concrete was transported to the work in side-dump concrete cars that ran over a narrow-gauge track, up over the levee, and across the river on top of the forms. It was not necessary to hoist any of the concrete into position. A gasoline locomotive did the hauling.

The contractor who had the special work of reinforcing the old piers used a very simple layout. Part of the time he had his mixer on top of the old bridge, and chuted the concrete down. The remainder of the time he brought in the concrete on a light trestle with a deck but a few feet above the water surface.

The job is now completed with the exception of backfilling and cleaning up. Within a few weeks the new bridge will be open to traffic.

Progress on the Work From June 27, 1922, to December 5, 1922

GERMANTOWN

Completed.

ENGLEWOOD

The rip-rap placing, which was in progress at the time of the last progress report, has been completed. The road over the top of the dam has been thrown open to traffic. The construction equipment has all been removed, the railroad track has been torn up and the job cleaned up. Englewood dam is entirely completed.

LOCKINGTON

Completed.

TAYLORSVILLE

Completed.

HUFFMAN

Completed.

DAYTON

The Dayton Channel improvement work has been completed.

The first of the three big machines to finish was the Lidgerwood, Class "K", D-16-8, which did its last work on the left levee, about 1,000 feet upstream from the Miller's Ford power plant, on August 26th. On September 21, the two Bucyrus, Class 175 draglines, D-16-15 and D-16-16 completed their work. They had been working toward each other on top of the left levee and met about 1,500 feet downstream from Stewart Street. After that date D-16-15 worked until October 28, under a special agreement with the National Cash Register Company, leveling down a pile of surplus material on their property.

There still remained some channel work around the bridges, for which a contract had been let. The contract was forfeited and, on August 25, the District took over the work. The last dragline work was done on November 15th.

At the mouth of Wolf Creek a concrete barrier has been constructed, to maintain the required difference in grade between the creek and the Miami River and to check the drifting of gravel into the river.

A third maintenance gravel plant has been installed. It is located on the south bank of Mad River west of Findlay Street.

Total channel excavation, Item 9, amounted to 2,025,000 cu. yds. Levee embankment amounted to 852,500 cu. yds. The total yardage handled in accomplishing this work was approximately 4,500,000 cubic yards. The total amount of concrete placed was 36,000 cu. yds.

C. A. BOCK, Division Engineer.

December 5, 1922.

HAMILTON

The electric dragline, D-16-18, made the outside cut on the east side of the river, between the Black Street bridge and the High-Main Street bridge, during the months of July and August. This machine moved south on the High-Main Street bridge September 1, and removed 146,000 cubic yards accretion between the High-Main Street bridge and

[illegible]

Further downstream, the vertical earth bank was sluiced down to a 2 to 1 slope, on which a bank protection of brush [illegible]

[illegible] nearing completion. This work will be completed in [illegible] concrete.

[illegible]

The dam, previously referred to, was completed November 3d. It is a concrete overfall dam, 801 feet long, and from seven to nine feet high above its foundation. It raises the ordinary low water level about five feet. The dam rests on a porous foundation. A continuous row of steel sheetpiling was placed at the end of the upstream [illegible]

[illegible]

R. B. McWHORTER, Division Engineer.

December 5, 1922

PIQUA

[illegible]

ALBERT SCHROEDER, Assistant Engineer

December 5, 1922

UPPER RIVER WORK

Troy—[illegible]

Tippecanoe City—[illegible]

[illegible] and the suction and discharge mains. So far about 800 ft of 12 inch discharge main has been laid on First Street [illegible]

A. F. GRIFFIN, Division Engineer.

December 5, 1922

LOWER RIVER WORK

West Carrollton—[illegible]

Miamisburg—[illegible] Miamisburg Paper Company. The Price Brothers Company was awarded the contract for, and have just about completed the construction of retaining walls north and south of Sycamore Creek and the widening of Main Street Bridge. Mr. Robert Rowan was awarded the contract and has completed the placing of a fill east of re- [illegible]

Franklin—Since the report dated June 26 the line of protection around the village has been completed, the last stretch of levee east of Front Street at south end, and terminating in high ground, having been placed. All revetment work on both sides of river has been completed by Price Brothers Company. The District's forces started and have about completed the construction of flood gate chambers in sewers crossing under levee.

Middletown—The Price Brothers Company have completed the flood gate structure in the Miami and Erie Canal at Tytus Avenue. The clearing of timber in the overflow area of river channel has also been completed. The District's forces have started on the construction of flood gate chambers on sewers crossing under levee.

F. G. BLACKWELL, Division Engineer.

December 12, 1922.

RAILROAD RELOCATION.

Big Four and Erie—Completed

Baltimore and Ohio—Completed.

Ohio Electric—Completed.

RIVER AND WEATHER CONDITIONS.

The most striking feature of the weather conditions since the date of the last Bulletin was the unusual period of dry weather during the late summer and fall. Stages of the river at Dayton were below the zero of the gauge all during the months of September, October and November, the lowest stage being –1.9 feet. Rainfall for October was 1.10 inches and for November 1.79 inches, the total deficiency from normal for the two months being 2.40 inches. On September 3 a very heavy local storm occurred over a portion of the valley just northwest of Hamilton, resulting in a rise of the Miami River at Hamilton of 10.8 feet in a few hours. The maximum recorded rainfall during this storm was 6.3 inches at Oxford.

Temperatures since the last report were mild. Unusually warm weather prevailed during the fall months of October and November, and the lowest temperature recorded to the date of this report was 23 degrees on November 26.

C. S. BENNETT, Field Engineer.

December 12, 1922.

Maintenance Organization.

The completion of the five dams of the Conservancy District, and the near approach of the completion of the river improvements has drawn attention to the problem of maintenance. The important thing now is to keep the system up to one hundred percent efficiency, ready for the supreme test whenever it may come.

To this end maintenance forces are being organized. A maintenance engineer has recently been selected, as note elsewhere in this Bulletin, and caretakers have been appointed to take care of the dams and river improvements. The works have been built for all time, and are as enduring as engineering skill can achieve with reasonable expense. But as time goes on any structure, however massive or secure, will show slight defects or deteriorations, and must be maintained to keep it up to the highest point of efficiency.

Careful, systematic maintenance is not an expensive process. But unsystematic or haphazard maintenance might prove to be literally and figuratively very costly. Deteriorations often start in such a small way that they can hardly be recognized as such in the beginning, and they often grow so gradually that their enlargement is hardly noticeable until a bad condition is created. The rain may wash gullies in the dams and levees. Flood gates or sewer outlets must be kept oiled and clean. The river channels must be watched to prevent the formation of bars and other obstructures. As long as the rivers continue to flow they will persist in carrying gravel and silt, and bars will form in certain places, in spite of the efforts that have been made to build a channel that will be nearly self maintaining. Careful study must be made of the bar-forming tendencies of the river, in order to devise the best and most economical method of keeping the channel clean. It is quite difficult, however, even under the most rigid inspection, to always detect changes in the channels and levees, unless careful records are kept, and measurements taken. A detailed inspection, done regularly by competent men whether changes are suspected or not, backed up with written records, and adequately supervised by some one competent to interpret what is found, is the first requisite. The second is to correct the defects in a workman-like manner.

Careful organization of the inspection work is therefore very necessary. The personnel must be made up of men who will go over the ground time after time, and who will see every change and every new development. They must have the most careful direction, as adequate planning is necessary in order that every part of the work may be covered.

Organization will be of even more importance during times of high water. Floods large enough to really test the flood prevention works will be relatively infrequent. When they do come they will give little warning. Every man connected with the levee patrol or other maintenance work must know what to do, as little opportunity will be given for instructions when the hour comes. Some men must see that the flood gates on the sewers are closed, others must patrol the levees and dams to observe the action of the water, and to watch for untoward incidents. Hydrographic measurements must be made of the streams, and much other information must be secured. One of the most important things will be the collecting of information on the behavior of the system under stress, as that information will be the basis on which the future maintenance policy will be based. During the construction period a levee patrol has been maintained, using the engineers employed on the construction organization. With the departure of these men, a new organization for that purpose must be developed.

An Additional Volume of the Technical Reports Now Ready.

An additional volume of the technical reports of The Miami Conservancy District is now ready for distribution. It is entitled Part IX, The Accounting and Cost Keeping System of the Department of Engineering and Construction, by F. L. Cavis, Chief Accountant of the District. It consists of 112 pages, 6 x 9 inches, and 31 illustrations, and is bound in paper covers. The price is 75 cents postpaid. The size and unique character of the enterprise, and the fact that it was public work, and carried out by the District's own forces, necessitated the development of an unusually complete accounting system. A construction organization, put together to do a big job, has to have a workable accounting system, ready made for it, and cannot wait on time and growth to rectify mistakes. This report presents an accounting system that has had unworkable features taken out of it under the pressure of actual operations.

The Concrete Overflow Dam at Hamilton

Barrier to Prevent Gravel Drifting Down Into the Improved Channel, Constructed Above Old River.

A concrete overflow dam built across the Miami River at the upper end of the river improvement at Hamilton has been a feature of the construction work this fall. The purpose of the barrier is to prevent gravel from drifting down into the improved channel through the city, there to form bars that would be expensive to remove. As long as rivers continue to flow, they will carry along with them, silt and gravel, especially at times of high water. The heavy gravels and sands, which are most troublesome of all the materials carried along by the water, travel on the bottom of the stream. A depression in the bed, plus a slight check in the velocity of the stream, will cause the materials to drop into the depression and stay there until the pit is filled. This dam will check the velocity of the Miami, and the basin above will form the pit in which the gravel and sand will drop. A sand and gravel plant will excavate the deposited material, screen it, and sell it for building material, and thus put a bad habit of the Miami River to beneficial use.

Reference to Figure 394, which is a cross-section of the highest section, will give the principal dimensions. The dam is built on a pervious foundation. The central part is an ogee weir, and is a gravity section,—that is, it will stand up against the tendency of the water back of it to overturn it, without re-enforcing steel. The broad aprons give it added stability, especially against the tendency of the water to push it downstream. The wide base also forces the water percolating through the pervious foundation under the dam and creeping along the lower side of the concrete to travel a considerable distance between the upper and lower toes. Head, which is nothing more than potential energy, is used up in forcing the water through the voids in the gravel. The longer the distance, the more head is used. Much of the destructive energy of the water is thus used up in friction, and the velocity of the percolating water is cut down so much that the material under the dam is not displaced or washed away. The cut off walls and the sheet piling at the upper toe help in this by adding to the distance the creeping water has to travel, and by giving some right angle turns to the direction of the creep. They also help anchor the dam in place. The wooden piles at the lower toe also serve as an anchor to the dam and to the flexible mat and in case of a washout at the toe, will hold up the apron. The wide flexible mat of concrete blocks, (see Figure 395) at the lower toe, is a protection for the toe of the dam against the scouring action of the water as it falls over the dam, and shoots with high velocity over the smooth concrete apron.

The abutments, built against the natural banks of the stream, vary in thickness from 36 inches at the bottom to 12 inches at the top. The east abutment is on a 2 to 1 slope, and the west one is a 3 to 1 slope. Both abutments are supported by toe walls 3 feet thick, which in turn are supported by a row of wooden piles 3 feet apart. The foundation material is sand and gravel, similar to the material under the main dam.

The aprons are re-inforced with 3/4 inch iron bars, laid 18 inches apart, and running up and down stream. The upper apron caps the tight wall of sheet steel piling, the lower apron caps the wooden piling. The cables for the flexible mat are anchored into

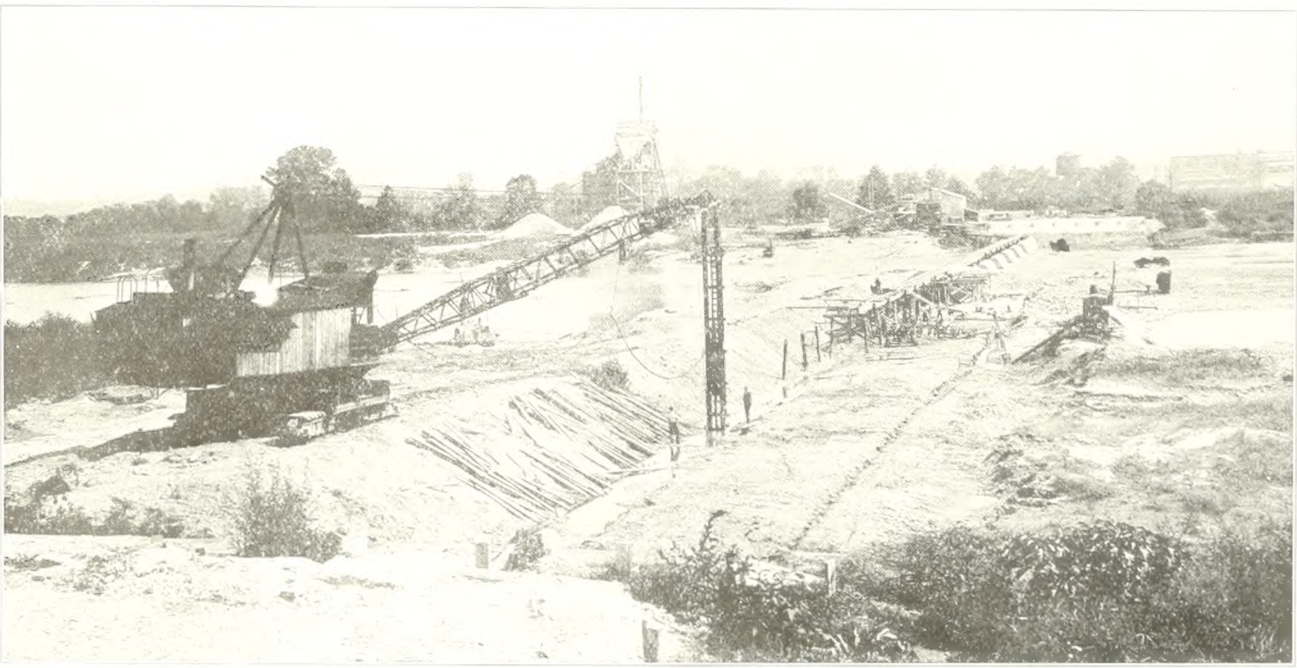

FIG. 393—GENERAL VIEW OF THE BARRIER DAM AT HAMILTON, SEPTEMBER 23, 1922.
The first section had been completed, and the river turned through the five gaps, when this view was taken. The coffer dam around the remainder of the dam had been built, and the water pumped out. The dragline in the foreground was engaged in driving piling, with the leads and hammer of the pile driver suspended from the end of the boom. The trestle carried the narrow gauge track used in the transportation of the concrete from the mixer to the forms.

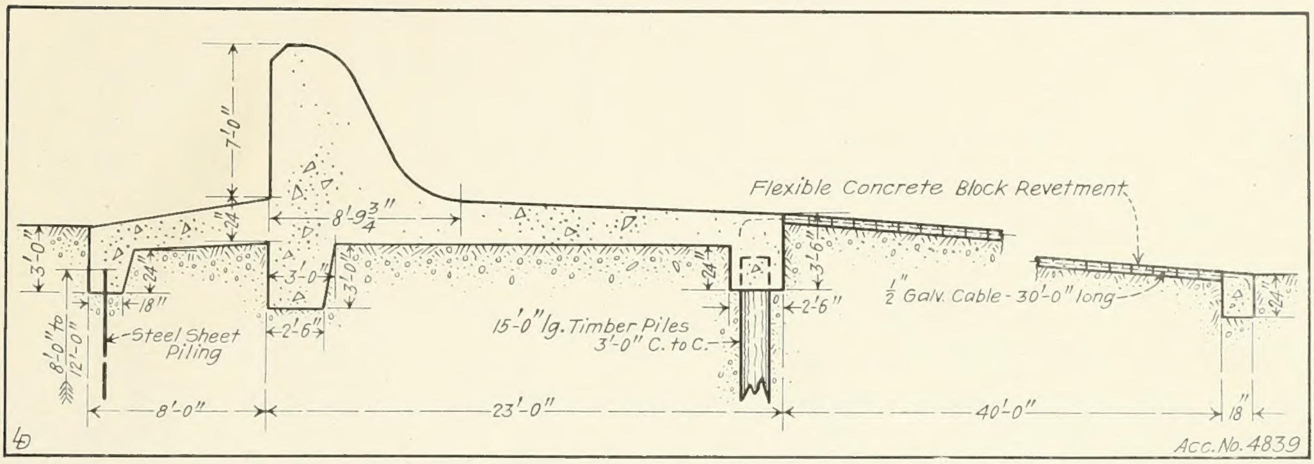

FIG. 394—CROSS-SECTION OF THE BARRIER DAM AT HAMILTON.

the toe of the downstream apron. The concrete block mat is composed of the same kind of blocks that are used to protect the toes of the levees, and is laid in a similar manner.

Some of the methods used in building the Black Street Bridge were employed to advantage. A dragline excavated one-half of the foundation, threw up an earth dyke around the excavation, and did the pile driving just like similar work was done at Black Street. An eight-inch centrifugal pump unwatered the pit, and had to run less than one half the time to keep the water down. A wooden trestle was built just above and two feet higher than the upstream crest of the dam. (See Figure 393). Narrow gauge track was laid, and concrete cars were handled over it by gasoline locomotives. The concrete mixing plant was on the bank. The foundation and the aprons were poured ahead of the spillway section, with joints every 30 feet, to provide for expansion and contraction. Beginning at the east end 90 feet of the spillway section was run in three 30 foot sections. Then alternate sections 30 feet long were poured, leaving gaps 24 feet long between, until five gaps were formed.

Then the coffer dam was cleared away, and the river was turned through the five gaps. Then the foundation for the remainder of the dam was dug, a dyke thrown up around it, the water pumped out, and the concreting operations repeated, save that no further gaps were left out.

When the last half was completed, the coffer dams were cleaned up. The dam was now completed save for the five gaps. These were closed one at a time. A small timber coffer dam on the upstream side shut off the water until the section could be filled with concrete.

When the last section was reached the water was very low in the river, as the Ford Plant was

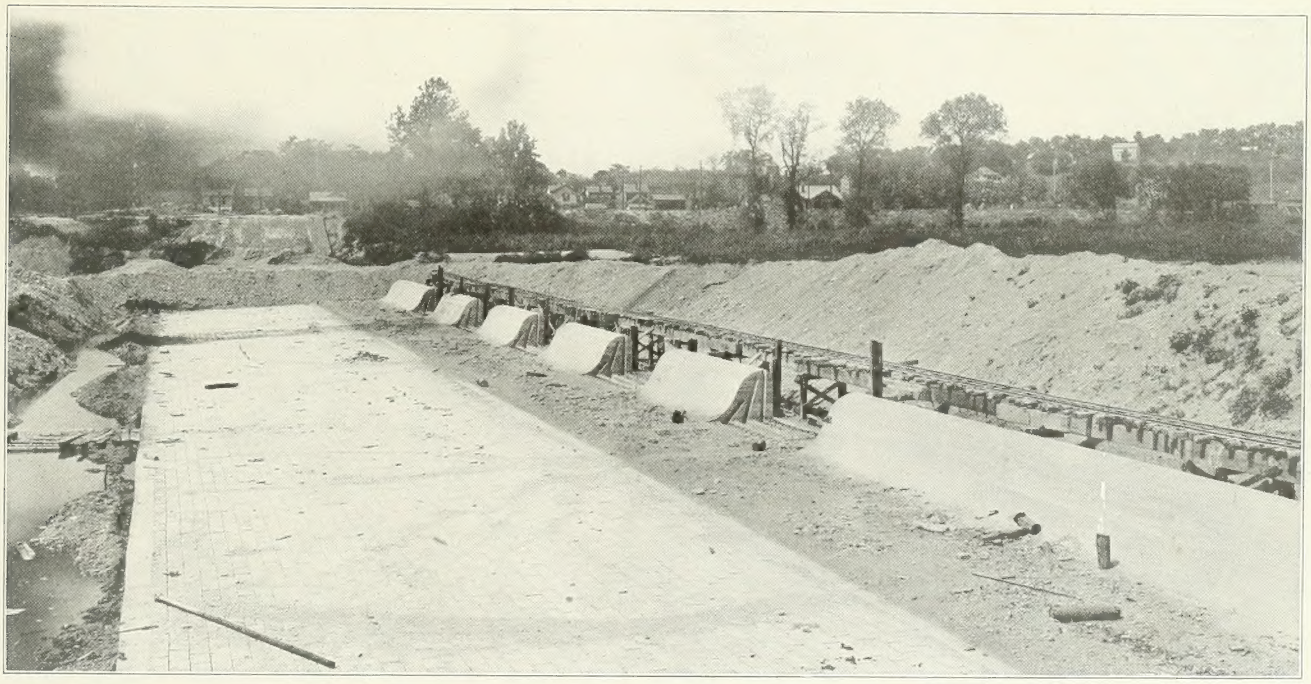

FIG. 395—THE FIRST SECTION OF THE BARRIER DAM AT HAMILTON, AUGUST 22, 1922.
The coffer dam was still in position. The five gaps in the spillway section were used to carry the river while the remainder of the dam was under construction. The trestle carried the track used in transporting concrete from the mixer to the forms.

using nearly all of it. After the opening was closed by the timber bulkhead it took 60 hours for the water to rise to the top of the dam. This allowed sufficient time for completing the forms, pouring the concrete and removing the forms. On this last section a hand pump was used to remove the water between the forms and the timber bulkhead, until the concrete had been poured and had set up.

An average day's work was 100 cubic yards. On the abutments and on the end walls for the flexible mat a small mixer and wheelbarrows were used. Work was started June 1, 1922 and was completed November 9th. There are about 3,000 cubic yards of concrete, and 16,000 blocks in the structure.

Besides the utilitarian features of the dam, a fine body of water has been formed, extending up to the railroad bridge. Several handsome groves of trees are on the banks, and raw material exists for a pleasure ground that will mean much to Hamilton.

Unusual Storm Occurs in September.

During the early morning hours of Sunday, September 3, a very unusual storm occurred over a portion of the valley just north and west of Hamilton. The recorded rainfall at Hamilton was 4.2 inches, at Oxford 6.3, at Eaton 2 inches, at Dayton 1.6, and at Cincinnati 1.6. Practically all of the rain fell between 1:30 and 7:00 A. M., and it is the opinion of most of the observers that a large portion of it fell within a two-hour period. The severe rainfall was practically all on the west side of the river at and above Hamilton, and on the east side of the river apparently there was no place where the rainfall was of unusually high intensity.

This storm was the cause of a sudden and destructive flood in the small streams in the western part of Butler County, and the southern part of Preble County, and produced a stage of 12.9 feet in the Miami River, at Hamilton. Approximately 25 County bridges were washed out on the various small streams in the region affected. Two Mile Creek and Four Mile Creek, coming into the Miami just above Hamilton, were very badly swollen. Four Mile Creek cut into its banks severely at Coke Otto, undermined a portion of the traction line and highway near the highway bridge, and overflowed considerable land in and around Coke Otto. About 20 or 30 families were driven from their homes.

At Two Mile Creek the North "B" Street bridge was wrecked by the undermining of the south abutment, which had been in bad shape for some time. This put the traction line out of business and necessitated the hurried construction of a temporary bridge by the C. & D. Traction Company.

Despite the unexpectedness of the rise, but little damage was done to the District property. The work was delayed four or five days by the washing out of the railroad track in the river bottom. The concrete barrier dam at Hamilton was under construction at the time of this flood and fears were had of its safety under such a head of water while it was in an incomplete state. When the waters receded, it was found that the only damage done was in the displacement of part of the timbers on the temporary trestle. The trestle was tied together with cable, so none of the material was washed away.

Conservancy Men Widely Scattered.

Recently while motoring through a magnificent pine forest, in southern California, and at an altitude of 9,000 feet, Mr. G. H. Matthes, formerly Assistant Engineer with the District, ran across A. F. McCarthy, formerly Chief Steward for the District. McCarthy was as hearty and genial as ever. He is feeding 2000 men, located in four camps, all situated high in the Sierras, and remote from towns. This winter, 1,000 men, engaged in driving a tunnel 13½ miles long, will be snowed in for seven mouths, with only a dog sled as communication with the outside world. McCarthy has the job of feeding these men so well that they will remain contented. This fall he has been busy getting in the supplies necessary to serve some six hundred thousand meals this winter. If anything is forgotten, the men will do without these articles, as nothing can be brought over the trail during the winter months. The work is being done by the Southern California Edison Company.

Mr. Matthes attended the American Society of Civil Engineers meeting in California, where he read a paper, and then he spent a month visiting engineering work on the coast before returning to Chattanooga, Tennessee, where he is engaged in an investigation and survey of the Tennessee River for the Government.

Lieutenant A. A. Ort of the U. S. Navy visited the work of the District in November. He was formerly Assistant Engineer with the District. He is now in Haiti, struggling with administration problems in that negro republic.

O. N. Floyd, formerly division engineer at Taylorsville, is in Texas, where he is Assistant Chief Engineer on the Wichita Falls work. T. C. Shuler, formerly at Huffman, is with him.

Barton M. Jones, former Division Engineer at Lockington, is now resident engineer on the flood prevention work at Pueblo, Colorado. With him are W. J. Smith and Ray Hahs, former Conservancy men.

A. L. Pauls, former Division Engineer at Germantown, is near Ishpeming, Michigan, where he is building a concrete dam.

P. W. McGinnis, formerly at Huffman, is in California helping build a dam in the mountains. L. E. Paul, formerly Field Clerk at Huffman, is working on the Ohio River dams.

Mr. Chas. H. Paul to Receive the Norman Medal.

Mr. Chas. H. Paul, chief engineer for The Miami Conservancy District, will receive the Norman medal at the annual meeting of the American Society of Civil Engineers on January 17, 1923. The Norman medal was instituted and endowed in 1872. It is awarded annually for a paper contributed to the Society during the year which shall be judged worthy of special commendation as a contribution to engineering science. The paper for which the award has been made to Mr. Paul is entitled "Core Studies in the Hydraulic Fill Dams of The Miami Conservancy District."

The presentation will be made on the first of a three day session of the Society, to be held in New York. Distinguished engineers from all over the United States will attend.